

## Test and Analysis of Solid Rocket Motor Nozzle Ablative Materials

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Asbestos free solid motor internal insulation samples were tested at the MSFC Hyperthermal Facility. Objectives of the test were to gather data for analog characterization of ablative and in-depth thermal performance of rubber materials subject to high enthalpy/pressure flow conditions. Tests were conducted over a range of convective heat fluxes for both inert and chemically reactive sub-sonic free stream gas flow. Instrumentation included use of total calorimeters, thermocouples, and a surface pyrometer for surface temperature measurement. Post-test sample forensics involved measurement of eroded depth, charred depth, total sample weight loss, and documentation of the general condition of the eroded profile. A complete Charring Material Ablator (CMA) style aero-thermal analysis was conducted for the test matrix and results compared to the measured data. In general, comparisons were possible for a number of the cases and the results show a limited predictive ability to model accurately both the ablative response and the in-depth temperature profiles. Lessons learned and modeling recommendations are made regarding future testing and modeling improvements that will increase understanding of the basic chemistry/physics associated with the complicated material ablation process of rubber materials.